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Pavillion / Toilet Ferrymead Park
PRK 2628 BLDG 001
Detailed Engineering Evaluation
Qualitative Report
Version Final

50 Ferrymead Park Drive, Ferrymead

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Pavilion/ Toilet Ferrymead Park
PRK 2628 BLDG 001

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Qualitative Report
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50 Ferrymead Park Drive, Ferrymead

Christchurch City Council

Prepared By
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Reviewed By
Stephen Lee

Date
17th May 2013

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Pavillion/Toilets Ferrymead Park

PRK 2628 BLDG 001

Detailed Engineering Evaluation

Qualitative Report - SUMMARY

Version Final

50 Ferrymead Park Drive, Ferrymead

Background

This is a summary of the Qualitative report for the building structure, and is based in part on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011, visual inspections on 24th May 2012, available construction drawings and bracing design calculations.

Building Description

The toilet/pavilion is located in Ferrymead Park in Ferrymead, Christchurch. There were no available plans for this building however, it is assumed to be built in 2004 and unaltered since that date. The structure is single storied and isolated from neighbouring buildings; it sits approximately 20m from a small river. The site is flat however, the land slopes downward toward the river shortly after the end of the foundation.

The structure is found on a concrete slab on grade and it is assumed to have strip footings. The foundations support concrete masonry walls which rise to 2.4m internally and 0.8m high on the exterior elevations. Each of these masonry walls has a timber framed wall built on top which supports a timber roof structure. All timber walls are clad with plywood.

The roof is timber framed and is covered by a plywood ceiling. Rafters and purlins provide adequate bracing to provide a diaphragm for the building. The roof extends further than the walls forming a veranda around the exterior of the building. This is supported by 170 x 170 mm timber columns on its outer edge.

Key Damage Observed

No structural damage was observed during the site investigation. However, there was some aesthetic damage which would not hinder the buildings seismic performance. This included paint flaking, loose veneer and some opening (~10mm) of the paving slab.

Critical Structural Weaknesses

The following potential critical structural weaknesses have been identified in the structure.

- Liquefaction Potential (30% reduction) (45% NBS)

Indicative Building Strength (from IEP and CSW assessment)

Based on the information available, and using the NZSEE Initial Evaluation Procedure, the original capacity of the building has been assessed to be in the order of 45% NBS and post-earthquake capacity also in the order of 45% NBS. The buildings post-earthquake capacity excluding critical structural weaknesses is in the order of 64% NBS.

The building has been assessed to have a seismic capacity in the order of 45% NBS and is therefore considered Earthquake Risk.

Recommendations

The building has been assessed as not being Earthquake Prone and as a result, the toilet/pavilion can remain occupied. CCC are not required to undertake a detailed seismic assessment, however due to the relatively low score, GHD recommend a detailed seismic assessment is carried out.

1. Background

GHD has been engaged by the Christchurch City Council (CCC) to undertake a detailed engineering evaluation of the Toilet/Pavilion at Ferrymead Park.

This report is a Qualitative Assessment of the building structure, and is based in part on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011.

A qualitative assessment involves inspections of the building and a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available.

The purpose of the assessment is to determine the likely building performance and damage patterns, to identify any potential critical structural weaknesses or collapse hazards, and to make an initial assessment of the likely building strength in terms of percentage of new building standard (%NBS).

At the time of this report, no intrusive site investigation, detailed analysis, or modelling of the building structure had been carried out. Construction drawings were made available, and these have been considered in our evaluation of the building. The building description below is based on a review of the drawings and our visual inspections.

2. Compliance

This section contains a brief summary of the requirements of the various statutes and authorities that control activities in relation to buildings in Christchurch at present.

2.1 Canterbury Earthquake Recovery Authority (CERA)

CERA was established on 28 March 2011 to take control of the recovery of Christchurch using powers established by the Canterbury Earthquake Recovery Act enacted on 18 April 2011. This act gives the Chief Executive Officer of CERA wide powers in relation to building safety, demolition and repair. Two relevant sections are:

Section 38 – Works

This section outlines a process in which the chief executive can give notice that a building is to be demolished and if the owner does not carry out the demolition, the chief executive can commission the demolition and recover the costs from the owner or by placing a charge on the owners' land.

Section 51 – Requiring Structural Survey

This section enables the chief executive to require a building owner, insurer or mortgagee carry out a full structural survey before the building is re-occupied.

We understand that CERA will require a detailed engineering evaluation to be carried out for all buildings (other than those exempt from the Earthquake Prone Building definition in the Building Act). It is anticipated that CERA will adopt the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011. This document sets out a methodology for both qualitative and quantitative assessments.

The qualitative assessment is a desk-top and site inspection assessment. It is based on a thorough visual inspection of the building coupled with a review of available documentation such as drawings and specifications. The quantitative assessment involves analytical calculation of the buildings strength and may require non-destructive or destructive material testing, geotechnical testing and intrusive investigation.

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:

- The importance level and occupancy of the building
- The placard status and amount of damage
- The age and structural type of the building
- Consideration of any critical structural weaknesses
- The extent of any earthquake damage

2.2 Building Act

Several sections of the Building Act are relevant when considering structural requirements:

Section 112 – Alterations

This section requires that an existing building complies with the relevant sections of the Building Code to at least the extent that it did prior to any alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) be satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'. Regarding seismic capacity 'as near as reasonably practicable' has previously been interpreted by CCC as achieving a minimum of 67% NBS however where practical achieving 100% NBS is desirable. The New Zealand Society for Earthquake Engineering (NZSEE) recommend a minimum of 67% NBS.

2.2.1 Section 121 – Dangerous Buildings

The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

- In the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
- In the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
- There is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or
- There is a risk that that other property could collapse or otherwise cause injury or death; or
- A territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property. A moderate earthquake is defined by the building regulations as one that would generate ground shaking 33% of the shaking used to design an equivalent new building.

Section 124 – Powers of Territorial Authorities

This section gives the territorial authority the power to require strengthening work within specified timeframes or to close and prevent occupancy to any building defined as dangerous or earthquake prone.

Section 131 – Earthquake Prone Building Policy

This section requires the territorial authority to adopt a specific policy for earthquake prone, dangerous and insanitary buildings.

2.3 Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in 2006. This policy was amended immediately following the Darfield Earthquake of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- Repair works for buildings damaged by earthquakes will be required to comply with the above.

The council has stated their willingness to consider retrofit proposals on a case by case basis, considering the economic impact of such a retrofit.

We anticipate that any building with a capacity of less than 33% NBS (including consideration of critical structural weaknesses) will need to be strengthened to a target of 67% NBS of new building standard as recommended by the Policy.

If strengthening works are undertaken, a building consent will be required. A requirement of the consent will require upgrade of the building to comply 'as near as is reasonably practicable' with:

- The accessibility requirements of the Building Code.
- The fire requirements of the Building Code. This is likely to require a fire report to be submitted with the building consent application.

2.4 Building Code

The building code outlines performance standards for buildings and the Building Act requires that all new buildings comply with this code. Compliance Documents published by The Department of Building and Housing can be used to demonstrate compliance with the Building Code.

After the February Earthquake, on 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
- Serviceability Return Period Factor increased from 0.25 to 0.33 (80% increase in the serviceability design loads when combined with the Hazard Factor increase)

The increase in the above factors has resulted in a reduction in the level of compliance of an existing building relative to a new building despite the capacity of the existing building not changing.

3. Earthquake Resistance Standards

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed as a percentage of new building standard (%NBS). The new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

The likely capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a buildings capacity based on a comparison of loading codes from when the building was designed and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 1 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance	
					Legal Requirement	NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement	Unacceptable	Unacceptable

Figure 1 NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE

Table 1 compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years (i.e. 0.2% in the next year). It is noted that the current seismic risk in Christchurch results in a 6% risk of exceedance in the next year.

Percentage of New Building Standard (%NBS)	Relative Risk (Approximate)
>100	<1 time
80-100	1-2 times
67-80	2-5 times
33-67	5-10 times
20-33	10-25 times
<20	>25 times

Table 1 %NBS compared to relative risk of failure

4. Building Description

4.1 General

The toilet/pavilion is located in Ferrymead Park in Ferrymead, Christchurch. There were no available plans for this building however, it is assumed to be built in 2004 and unaltered since that date.

The structure is a single storied and isolated from neighbouring buildings; it sits approximately 20m from a small river. The site is flat however, the land slopes downward toward the river shortly after the end of the foundation.

The structure is found on a concrete slab on grade and it is assumed to have strip footings. The foundations support concrete masonry walls which rise to 2.4m internally and 0.8m high on the exterior elevations. Each of these masonry walls has timber framed walls built on top which support a timber roof structure. All timber walls are clad with plywood.

The roof is timber framed and is covered by a plywood ceiling. Rafters and purlins have adequate bracing to provide a diaphragm for the building. The roof extends further than the walls forming a veranda around the exterior of the building. This is supported by 170 x 170 mm timber columns on its outer edge.

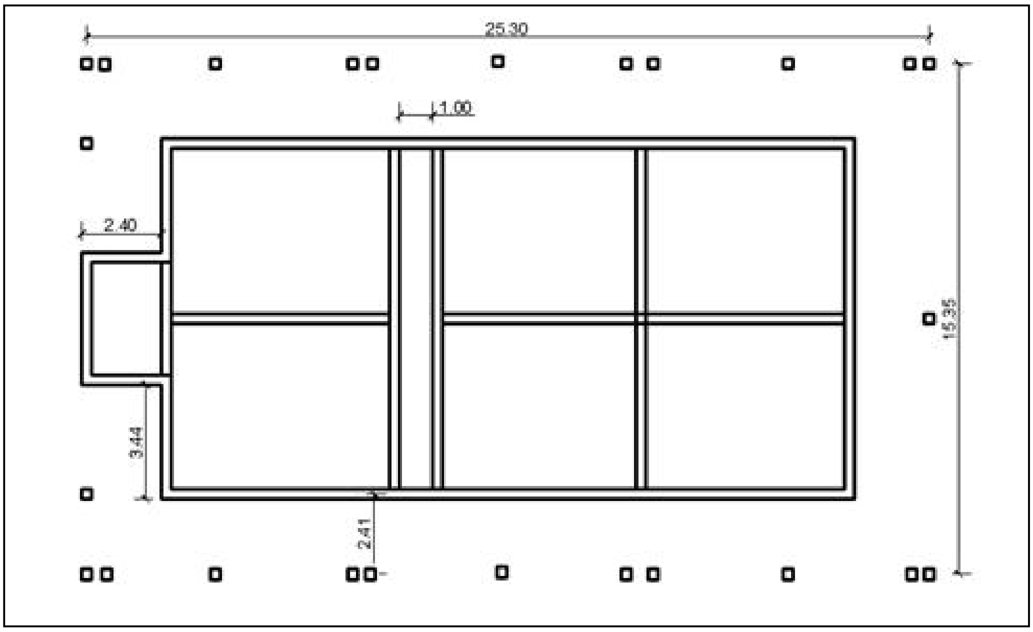


Figure 2 Plan Sketch Showing Key Structural Elements

The building covers a plan area of approximately 383.23 square meters and stands 5.3 meters tall.

No plans were available.

4.2 Gravity Load Resisting System

Gravity roof loads are initially carried by the purlins and rafters in the timber framed roof. Gravity loads are then transferred into the timber framed walls which are of varying heights. Loads from the timber framed walls are transferred directly downward into the concrete masonry walls, to the assumed strip footings and finally into the ground. Floor gravity loads are transferred through the concrete floor slab and into the ground.

Gravity loads that are produced by the veranda/roof are partially carried by the timber columns which surround the building. These loads are passed directly through the columns, to the foundation and into the ground.

Internal gravity loads are passed directly into the slab on grade and into the ground.

4.3 Lateral Load Resisting System

In the transverse direction the rigid roof acts as a diaphragm which redistributes lateral roof loads to the walls in the plane of loading. The lateral loads are then resisted by the panel action of the concrete masonry and timber walls and are passed to the foundation and finally to the ground.

In the longitudinal direction the lateral roof loads are transferred from the purlins, via the roof trusses to the walls in the plane of loading. The panel action of these walls transfers the longitudinal loads into the foundation.

Out of plane the timber walls are restrained by the diaphragm action provided by the roof structure. However, the pinned connection between the timber and concrete masonry walls means the roof diaphragm action will not support the lower concrete masonry walls out of plane. The flexural action of the horizontal steel bars in the concrete masonry walls will provide the resistance to these out of plane loads.

In plane there will be some nominal frame action produced by the perimeter veranda timber columns which will contribute to the structures lateral resistance in both the transverse and longitudinal directions.

5. Assessment

An inspection of the building was undertaken on the 24th of May, 2012. Both the interior and exterior of the building were inspected. The main structural components of the roof of the building were not all able to be viewed. Similarly the foundations were unable to be viewed.

The inspection consisted of scrutinising the building to determine the structural systems and likely behaviour of the building during an earthquake. The site was assessed for damage, including examination of the ground conditions, checking for damage in areas where damage would be expected for the type of structure and noting general damage observed throughout the building in both structural and non-structural elements.

The %NBS score determined for this building has been based on the IEP procedure described by the NZSEE and based on the information obtained from visual observation of the building.

6. Damage Assessment

6.1 Surrounding Buildings

No damage was noted to the surrounding building, approximately 100 meters to the east.

6.2 Residual Displacements and General Observations

No residual displacements of the structure were noticed during our inspection of the building.

There was no obvious structural damage to the building however the following aesthetic damage was noted:

- Loose stone veneer around the base of the columns.
- ~ 10 mm openings between the paving slabs.
- Paint flaking on the interior of the building.

6.3 Ground Damage

There was no evidence of ground damage on the property.

7. Critical Structural Weakness

7.1 Short Columns

No short columns are present in the structure.

7.2 Lift Shaft

The building does not contain a lift shaft.

7.3 Roof

Not all of the roof was able to be seen however, Roof elements such as ply ceilings, purlins and rafters were visible and are expected to provide bracing to the roof structure.

7.4 Staircases

The building does not contain a staircase.

7.5 Site Characteristics

Following the geotechnical appraisal it was found that the site has a moderate to high potential for liquefaction. For the purposes of the IEP assessment of the building and the determination of the %NBS score, the effects of soil liquefaction on the performance of the building has been assessed as a 'significant' site characteristic in accordance with the NZSEE guidelines.

7.6 Plan Irregularity

This structure is not plan irregular.

7.7 Vertical irregularity

This structure is not vertically irregular.

7.8 Pounding effect

This subject will not be subject to pounding.

8. Geotechnical Consideration

8.1 Site Description

The site is situated within a recreational reserve, in southeast Christchurch. It is relatively flat at approximately 3m above mean sea level. It is approximately 70m southwest of an unnamed water channel, 300m south of the Heathcote River and estuary, and 3.5km west of the coast at Southshore.

8.2 Published Information on Ground Conditions

8.2.1 Published Geology

The geological map of the area[1] indicates that the site is underlain by Holocene marine/estuarine soils of the Christchurch Formation, comprising sand, silt, and peat of drained lagoons and estuaries.

8.2.2 Environment Canterbury Logs

Information from Environment Canterbury (ECan) indicates that no boreholes are located within 200m of the site (see Table 2). However, boreholes with lithographic logs further away indicate the area is typically underlain by sands and silts.

Table 2 ECan Borehole Summary

Bore Name	Log Depth	Groundwater	Distance & Direction from Site
M36/6958	6m	-	340m NW
M36/6959	6m	-	300m NW

It should be noted that the boreholes were sunk for groundwater extraction and not for geotechnical purposes. Therefore, the amount of material recovered and available for interpretation and recording will have been variable at best and may not be representative. The logs have been written by the well driller and not a geotechnical professional or to a standard. In addition strength data is not recorded.

8.2.3 EQC Geotechnical Investigations

The Earthquake Commission has not undertaken geotechnical testing in the area of the subject site.

8.2.4 Land Zoning

Canterbury Earthquake Recovery Authority (CERA) has indicated the site is situated within the Green Zone, indicating that repair and rebuild may take place.

[1] Brown, L. J. and Weeber, J.H. 1992: *Geology of the Christchurch Urban Area*. Institute of Geological and Nuclear Sciences 1:25,000 Geological Map 1. Lower Hutt. Institute of Geological and Nuclear Sciences Limited.

Land in the CERA green zone has been divided into three technical categories. These categories describe how the land in expected to perform in future earthquakes. However, the subject site does not have a technical category (N/A) as it is considered non-residential.

8.2.5 Post February Aerial Photography

Aerial photography taken following the 22 February 2011 earthquake shows no signs of liquefaction outside the building footprint, but minor evidence is visible to the north of the building, as shown in Figure 3.

Figure 3 Post February 2011 Earthquake Aerial Photography [2]

8.2.6 Summary of Ground Conditions

From the information presented above, the ground conditions underlying the site are anticipated to comprise sands and silts.

[2] Aerial Photography Supplied by Koordinates sourced from http://koordinates.com/layer/3185-christchurch-post-earthquake-aerial-photos-24-feb-2011/

8.3 Seismicity

8.3.1 Nearby Faults

There are many faults in the Canterbury region, however only those considered most likely to have an adverse effect on the site are detailed below.

Table 3 Summary of Known Active Faults[3,4]

Known Active Fault	Distance from Site	Direction from Site	Max Likely Magnitude	Avg Recurrence Interval
Alpine Fault	130 km	NW	~8.3	~300 years
Greendale (2010) Fault	28 km	W	7.1	~15,000 years
Hope Fault	110 km	N	7.2~7.5	120~200 years
Kelly Fault	110 km	NW	7.2	~150 years
Porters Pass Fault	65 km	NW	7.0	~1100 years

Recent earthquakes since 4 September 2010 have identified the presence of a previously unmapped active fault system underneath the Canterbury Plains, including Christchurch City, and the Port Hills. Research and published information on this system is in development and not generally available. Average recurrence intervals are yet to be estimated.

8.3.2 Ground Shaking Hazard

This seismic activity has produced earthquakes of Magnitude-6.3 with peak ground accelerations (PGA) up to twice the acceleration due to gravity (2g) in some parts of the city. This has resulted in widespread liquefaction throughout Christchurch.

New Zealand Standard NZS 1170.5:2004 quantifies the Seismic Hazard factor for Christchurch as 0.30, being in a moderate to high earthquake zone. This value has been provisionally upgraded recently (from 0.22) to reflect the seismicity hazard observed in the earthquakes since 4 September 2010.

8.4 Slope Failure and/or Rockfall Potential

The topography surrounding the site suggests that rockfall is not a potential hazard. However, given its proximity to the Heathcote River and other water channels, the site may be susceptible to lateral spreading. In addition, any retaining structures or embankments nearby should be further investigated to determine the site-specific local slope instability potential.

[3] Stirling, M.W, McVerry, G.H, and Berryman K.R. (2002) A New Seismic Hazard Model for New Zealand, Bulletin of the Seismological Society of America, Vol. 92 No. 5, pp 1878-1903, June 2002.

[4] GNS Active Faults Database

8.5 Liquefaction Potential

Due to the presence of sands and silts underlying the site, and evidence from the post-earthquake aerial photography it is considered possible and likely that liquefaction will occur in a moderate to significant seismic event.

Further investigation is recommended to better determine subsoil conditions. From this, a more comprehensive liquefaction assessment could be undertaken.

8.6 Recommendations

A soil class of **D/E** (in accordance with NZS 1170.5:2004) should be adopted for the site.

Due to the relative paucity of location-specific ground information, and location of the site, it is recommended that intrusive investigation comprising at least one piezocone CPT be conducted. This will allow a more comprehensive liquefaction and/or ground condition assessment to be carried out, and result in the recommended soil class being better defined.

8.7 Conclusions & Summary

This assessment is based on a review of the geology and existing ground investigation information, and observations from the Christchurch earthquakes since 4 September 2010.

The site appears to be situated on estuarine deposits, comprising sand, silt and peat. Associated with this the site also has a moderate to high liquefaction potential, in particular where sands and/or silts are present.

It is recommended that intrusive investigation comprising at least one piezocone CPT be conducted. This will allow a more comprehensive liquefaction and/or ground condition assessment to be carried out.

A soil class of **D/E** (in accordance with NZS 1170.5:2004) should be adopted for the site.

9. Survey

No level or verticality surveys have been undertaken for this building at this stage as indicated by Christchurch City Council guidelines.

10. Initial Capacity Assessment

10.1 % NBS Assessment

The building has had its capacity assessed using the Initial Evaluation Procedure based on the information available. Table 4 shows the buildings capacity including and excluding critical structural weaknesses; it is expressed as a percentage of new building standard (%NBS). These capacities are subject to confirmation by a more detailed quantitative analysis.

Item	%NBS
Building excluding CSW's	64
Liquefaction Potential (30% reduction)	45

Table 4 Indicative Building and Critical Structural Weaknesses Capacities based on the NZSEE Initial Evaluation Procedure

Following an IEP assessment, the building has been assessed as achieving 45% New Building Standard (NBS). Under the New Zealand Society for Earthquake Engineering (NZSEE) guidelines the building is considered Earthquake Risk as it achieves greater than 34% and less than 67% NBS. This score has not been adjusted when considering damage to the structure as all damage observed was relatively minor and considered unlikely to adversely affect the load carrying capacity of the structural systems.

10.2 Seismic Parameters

The seismic design parameters based on current design requirements from NZS 1170:2002 and the NZBC clause B1 for this building are:

- Site soil class D/E, NZS 1170.5:2004, Clause 3.1.3, Soft Soil
- Site hazard factor, Z = 0.3, NZBC, Clause B1 Structure, Amendment 11 effective from 1 August 2011
- Return period factor R_u = 1.0, NZS 1170.5:2004, Table 3.5, Importance level 2 structure with a 50 year design life.

An increased Z factor of 0.3 for Christchurch has been used in line with requirements from the Department of Building and Housing resulting in a reduced % NBS score.

10.3 Expected Structural Ductility Factor

A structural ductility factor of 1.25 has been assumed based on the structural system observed and the date of construction.

10.4 Discussion of Results

The results obtained from the initial IEP assessment are consistent with those expected for a building of this age and construction type. The building was likely designed to the standard relevant at the time NZS 1170:2004 The design loads used in this standard are likely to have been less than those required by the current loading standard. When combined with the increase in the hazard factor for Christchurch to 0.3, it would be expected that the building would not achieve 100% NBS.

10.5 Occupancy

The building does not pose an immediate risk to users and occupants although a critical structural weakness has been identified. The building has not been assessed as being Earthquake Prone and as a result can remain occupied.

11. Initial Conclusions

The building has been assessed to have a seismic capacity in the order of 45% NBS and is therefore considered potentially Earthquake Risk.

12. Recommendations

The recent seismic activity in Christchurch appears to have only caused minor damage to the building. The building has been assessed as not being Earthquake Prone and has achieved between 34% and 67% NBS. As a result, the toilet/pavilion can remain occupied. CCC are not required to undertake a detailed seismic assessment, however due to the relatively low score, GHD recommend that further investigation be completed to determine accurately the structures seismic capacity.

13. Limitations

13.1 General

This report has been prepared subject to the following limitations:

- No intrusive structural investigations have been undertaken.
- No intrusive geotechnical investigations have been undertaken.
- Visual inspections of the sub-floor space were not completed and as a result the entirety of the subfloor space was not inspected.
- Visual inspections of the roof space were limited to the openings in the ceiling and therefore the entirety of the roof space was not inspected.
- No level or verticality surveys have been undertaken.
- No material testing has been undertaken.
- No calculations, other than those included as part of the IEP in the CERA Building Evaluation Report, have been undertaken. No modelling of the building for structural analysis purposes has been performed.

It is noted that this report has been prepared at the request of Christchurch City Council and is intended to be used for their purposes only. GHD accepts no responsibility for any other party or person who relies on the information contained in this reportrite a specific limitations section.

13.2 Geotechnical Limitations

This report presents the results of a geotechnical appraisal prepared for the purpose of this commission, and for prepared solely for the use of Christchurch City Council and their advisors. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent geotechnical engineer before being used for any other purpose. GHD Limited (GHD) accepts no responsibility for other use of the data.

The advice tendered in this report is based on a visual geotechnical appraisal. No subsurface investigations have been conducted. An assessment of the topographical land features have been made based on this information. It is emphasised that Geotechnical conditions may vary substantially across the site from where observations have been made. Subsurface conditions, including groundwater levels can change in a limited distance or time. In evaluation of this report cognisance should be taken of the limitations of this type of investigation.

An understanding of the geotechnical site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experienced based. Hence this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances, which arise from the issue of the report, which have been modified in any way as outlined above.

Appendix A

Photographs

Photograph 1 North elevation.

Photograph 2 East Elevation.

Photograph 3 South Elevation.

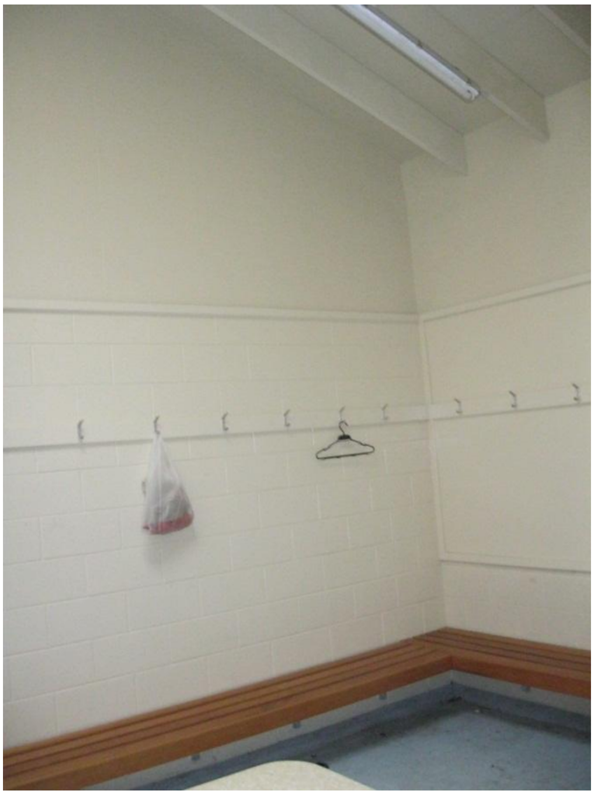
Photograph 4 West Elevation.

Photograph 5 Roof structure.

Photograph 6 Roof structure.

Photograph 7 Flaking of paint work.

Photograph 8 Timber and masonry Interior wall.



Photograph 9 Timber and masonry interior wall.

Appendix B

CERA Building Evaluation Form

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Pavillion / Toilet Ferrymead Park			Reviewer:	Stephen Lee
	Unit	No:	Street	CPEng No:	1006840
Building Address:		50	Ferrymead Park Dr, Ferrymead	Company:	GHD
Legal Description:	Lot 1 DP 29440			Company project number:	513090206
				Company phone number:	04 472 0799
	Degrees	Min	Sec		
GPS south:	43	34	0.00	Date of submission:	17/05/2013
GPS east:	172	42	26.00	Inspection Date:	24/05/2012
				Revision:	Final
Building Unique Identifier (CCC):	PRK 2628 BLDG 001			Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	mixed	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):	20	If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	
Ground floor split?	yes		Ground floor elevation above ground (m):	
Storeys below ground				
Foundation type:	strip footings		if Foundation type is other, describe:	
Building height (m):			height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):				
Age of Building (years):			Date of design:	2004-
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	public		Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

<u>Gravity Structure</u>

Gravity System:	load bearing walls		
Roof:	timber framed	rafter type, purlin type and cladding	
Floors:	concrete flat slab	slab thickness (mm)	
Beams:	timber	type	
Columns:	timber	typical dimensions (mm x mm)	
Walls:	fully filled concrete masonry	#N/A	

<u>Lateral load resisting structure</u>

Lateral system along:	fully filled CMU	**Note: Define along and across**		
Ductility assumed, μ:	1.25	**in detailed report!**	note total length of wall at ground (m):	

Period along:	0.40	#### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	fully filled CMU			
Ductility assumed, μ:	1.25		note total length of wall at ground (m):	
Period across:	0.40	#### enter height above at H31	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

north (mm):		leave blank if not relevant
east (mm):		
south (mm):		
west (mm):		

Non-structural elements

Stairs:			
Wall cladding:	other light	describe	Plywood Cladding on timber walls
Roof Cladding:	Metal	describe	
Glazing:	timber frames		
Ceilings:	plaster, fixed		Plywood
Services(list):			

Available documentation

Architectural	none	original designer name/date	
Structural	none	original designer name/date	
Mechanical	none	original designer name/date	
Electrical	none	original designer name/date	
Geotech report	full	original designer name/date	

Damage

Site:
(refer DEE Table 4-2)

Site performance:	Good	Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:			
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			

$$Damage\_Ratio = \frac{(\%NBS(before) - \%NBS(after))}{\%NBS(before)}$$

Diaphragms	Damage?: no	Describe:	
CSWs:	Damage?: no	Describe:	
Pounding:	Damage?: no	Describe:	
Non-structural:	Damage?: yes	Describe:	Opening of paving slab ~10mm

Recommendations

Level of repair/strengthening required:	none	Describe:	
Building Consent required:	no	Describe:	
Interim occupancy recommendations:	full occupancy	Describe:	

Along	Assessed %NBS before e'quakes:	49%	45% %NBS from IEP below	If IEP not used, please detail assessment methodology:
	Assessed %NBS after e'quakes:	49%		
Across	Assessed %NBS before e'quakes:	49%	45% %NBS from IEP below	
	Assessed %NBS after e'quakes:	49%		

IEP **Use of this method is not mandatory - more detailed analysis may give a different answer, which would take precedence. Do not fill in fields if not using IEP.**

Period of design of building (from above): 2004-

h_n from above: m

Seismic Zone, if designed between 1965 and 1992:

Design Soil type from NZS1170.5:2004, cl 3.1.3: E very soft soil

not required for this age of building

	along	across
Period (from above):	0.4	0.4
(%NBS)nom from Fig 3.3:	22.3%	22.3%

Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0	1.00
Note 2: for RC buildings designed between 1976-1984, use 1.2	1.0
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)	1.0

	along	across
Final $(\%NBS)_{nom}$:	**22%**	**22%**

2.2 Near Fault Scaling Factor

Near Fault scaling factor, from NZS1170.5, cl 3.1.6: 1.00

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	1	1

2.3 Hazard Scaling Factor

Hazard factor Z for site from AS1170.5, Table 3.3:	0.30
Z_{1992}, from NZS4203:1992	0.8
Hazard scaling factor, **Factor B:**	2.666666667

2.4 Return Period Scaling Factor

Building Importance level (from above):	2
Return Period Scaling factor from Table 3.1, **Factor C**:	1.00

		along	across
2.5 Ductility Scaling Factor	Assessed ductility (less than max in Table 3.2)	1.25	1.25
	Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:	1.00	1.00
	Ductiity Scaling Factor, **Factor D**:	1.00	1.00
2.6 Structural Performance Scaling Factor:	Sp:	0.925	0.925
	Structural Performance Scaling Factor **Factor E**:	1.081081081	1.081081081
2.7 Baseline %NBS, $(NBS\%)_b = (\%NBS)_{nom}$ x A x B x C x D x E	**$\%NBS_b$:**	**64%**	**64%**

Global Critical Structural Weaknesses: (refer to NZSEE IEP Table 3.4)

3.1. Plan Irregularity, factor A:	insignificant	1
3.2. Vertical irregularity, Factor B:	insignificant	1
3.3. Short columns, Factor C:	insignificant	1
3.4. Pounding potential Pounding effect D1, from Table to right		1.0
Height Difference effect D2, from Table to right		1.0
Therefore, Factor D:		1
3.5. Site Characteristics	significant	0.7

Table for selection of D1	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Alignment of floors within 20% of H	**0.7**	**0.8**	**1**
Alignment of floors not within 20% of H	**0.4**	**0.7**	**0.8**

Table for Selection of D2	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Height difference > 4 storeys	0.4	0.7	1
Height difference 2 to 4 storeys	0.7	0.9	1
Height difference < 2 storeys	1	1	1

		Along	Across
3.6. Other factors, Factor F	For ≤ 3 storeys, max value =2.5, otherwise max valule =1.5, no minimum	1.0	1.0
	Rationale for choice of F factor, if not 1	1	1

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)

List any: Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

3.7. Overall Performance Achievement ratio (PAR)		**0.70**	**0.70**
4.3 PAR x (%NBS)b:	PAR x Baselline %NBS:	**45%**	**45%**
4.4 Percentage New Building Standard (%NBS), (before)			**45%**

Official Use only:

Accepted By

Date:

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